Gulf Coast Joint Venture:

Mobile Bay Initiative

North American
Waterfowl
Management Plan

2002

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Gulf Coast Joint Venture:

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NORTH AMERICAN
WATERFOWL
MANAGEMENT PLAN

This is one of six reports that address initiative plans for the entire North American Waterfowl Management Plan, Gulf Coast Joint Venture: the Chenier Plain Initiative, the Laguna Madre (Texas) Initiative, the Texas Mid-Coast Initiative, the Coastal Mississippi Wetlands Initiative, the Mobile Bay Initiative, and the Mississippi River Coastal Wetlands Initiative (southeast Louisiana).

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Contents

Figures

Tables

Introduction

North American Waterfowl Management Plan

Faced with continuing wetland destruction and rapidly declining waterfowl populations, the Canadian and U.S. governments signed the North American Waterfowl Management Plan (NAWMP) in 1986, undertaking an intense effort to protect and restore North America's waterfowl populations and their habitats. Updated in 1994 and 1998 with Mexico as a signatory, the NAWMP recognizes that the recovery and perpetuation of waterfowl populations to levels observed in the 1970's, which is the baseline reference for duck population objectives under the plan, depends on restoring wetlands and associated ecosystems throughout the continent. The purpose of the NAWMP is to achieve waterfowl conservation while maintaining or enhancing associated ecological values in harmony with human needs. The benefits of such habitat conservation were recognized to be applicable to a wide array of other species as well. Six priority habitat ranges, including the western U.S. Gulf of Mexico coast (hereafter Gulf Coast), were identified in the 1986 document and targeted as areas to begin implementation of the NAWMP.

Transforming the goals of the NAWMP into actions requires a cooperative approach to conservation. The implementing mechanisms of the NAWMP are regional partnerships called joint ventures. A joint venture is composed of individuals, corporations, small businesses, sportsmen's groups, conservation organizations, and local, state, provincial, and federal agencies that are concerned with conserving migratory birds and their habitats in a particular physiographic region such as the Gulf Coast. These partners come together under the NAWMP to pool resources and accomplish collectively what is often difficult or impossible to do individually.

Gulf Coast Joint Venture

The Gulf Coast is the terminus of the Central and Mississippi Flyways and is therefore one of the most important waterfowl areas in North America, providing both wintering and migration habitat for significant numbers of the continental duck and goose populations that use both flyways. The coastal marshes of Louisiana, Mississippi, and Alabama regularly hold half of the wintering duck population of the Mississippi Flyway. Coastal wetlands of Texas are the primary wintering site for ducks using the Central Flyway, wintering more than half of the Central Flyway waterfowl population. The greatest contribution of the Gulf Coast Joint Venture (GCJV) region (Fig. 1) in fulfilling the goals of the NAWMP is

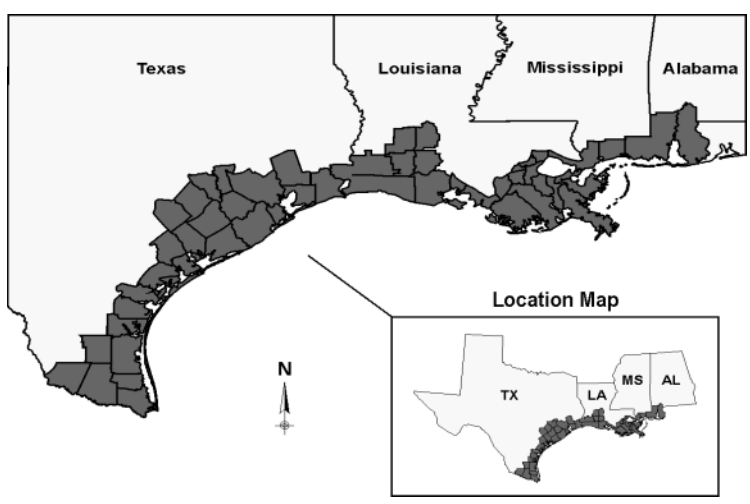


Figure 1. Location of the Gulf Coast Joint Venture region.

as a wintering ground for waterfowl. The GCJV also provides year-round habitat for over 90% of the continental population of mottled ducks and serves as a key breeding area for whistling ducks. In addition, hundreds of thousands of waterfowl use the Gulf Coast as stopover habitat while migrating to and from Mexico and Central and South America. The GCJV region is the primary wintering range for several species of ducks and geese and is a major wintering area for every other North American duck except wood ducks, American black ducks, cinnamon teal, and some sea ducks (Tribe Mergini).

Through its wetland conservation accomplishments, the GCJV is contributing to the conservation of biological diversity. While providing habitat for waterfowl, especially ducks, continues to be the major focus of the GCJV, a great diversity of birds, mammals, fish, and amphibians also rely on the wetlands of the Gulf Coast for part of their life cycles. Numerous species of shorebirds, wading birds, raptors, and songbirds can be found along the Gulf Coast. Of the 650 species of birds known to occur in the United States, nearly 400 species are found in the GCJV area. Muskrats and nutria have historically been important commercial fur species of the Gulf Coast. Many species of fish, shellfish, and other marine organisms also depend on the gulf coastal ecosystem. Almost all of the commercial fish and shellfish harvested in the Gulf of Mexico are dependent on the area's estuaries and wetlands that are an integral part of coastal ecosystems. The American alligator is an important Gulf Coast region species and is sought commercially and recreationally for its hide and meat.

Gulf Coast Joint Venture Objectives

Conserving Gulf Coast habitats is critical to the overall success of the NAWMP because the area provides extensive wetlands that are vitally important to traditional wintering waterfowl concentrations. The primary goal of the GCJV is to provide habitat for waterfowl in winter and ensure that they survive and return to the breeding grounds in good condition, but not exceeding levels commensurate with breeding habitat capacity as is the case with midcontinent lesser snow and Ross' geese. A secondary goal is to provide ample breeding and postbreeding habitat for resident waterfowl. Actions that will achieve and maintain healthy wetland ecosystems that are essential to waterfowl will be pursued. Wetland conservation actions that will provide benefits to species of fish and wildlife, in addition to waterfowl, will also be supported.

The emergence of the U.S. Shorebird Conservation Plan, Partners in Flight physiographic plans, and the Waterbird Conservation Plan, which address conservation of other North American migratory birds, presents opportunities to broaden and strengthen joint venture partnerships for wetland conservation. As definitive population data and habitat needs are developed for the migratory birds represented in these emerging strategies, areas of mutual concern in wetland ecosystems can be identified. These wetland areas of overlapping interest in the GCJV will be candidate priority sites for the integrated design and delivery of habitat conservation efforts. Although wetland conservation projects cannot be designed to provide maximum benefits for all concerned species, they can be designed to maximize the overlap of benefits between the species groups. The joint venture will strive to balance its focus on waterfowl and wetlands with the need to expand coordination and cooperation with existing conservation initiatives that promote common purposes, strategies, or habitats of interest.

The GCJV is divided geographically into six initiative areas, each with a different mix of habitats, management opportunities, and species priorities. This document deals with planning efforts for the Mobile Bay Initiative area (Fig. 2). The goal of the Mobile Bay Initiative is to provide wintering and migration habitat for greater and lesser scaup, canvasbacks, and numerous puddle duck species (Table 1).

Midwinter Duck Population Objectives

To obtain objectives for midwinter duck populations in the GCJV Initiative areas, we started with the

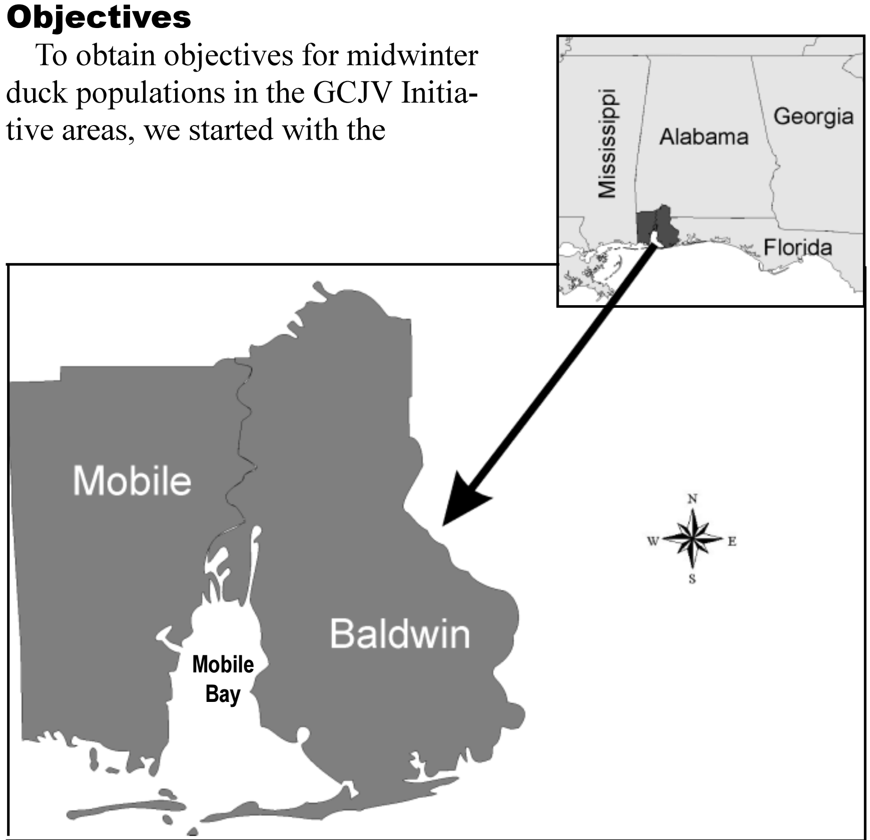


Figure 2. Mobile Bay Initiative area.

Table 1. Midwinter population objectives[1,2] for initiative areas of the GCJV. (See Derivation of GCJV Waterfowl Objectives and Migration Patterns section of this plan, p. 23, for information about the methods used to develop these goals.)

	Laguna Madre	Texas Mid-Coast	Chenier Plain (Texas)	Chenier Plain (Louisiana)	Mississippi River Coastal Wetlands	Coastal Mississippi Wetlands	Mobile Bay	Total
Mallard	13,530	72,819	44,632	515,895	249,257	619	451	897,203
Northern pintail	173,355	775,755	124,193	396,313	99,967	0	1,236	1,570,819
Gadwall	46,200	224,926	84,039	888,456	714,356	268	2,286	1,960,531
American wigeon	100,377	93,841	29,147	423,845	264,119	191	1,711	913,231
Green-winged teal	35,160	293,574	650,395	951,853	537,313	413	2,544	2,471,250
Blue-winged teal	1,707	23,941	147,053	378,953	723,140	1,738	1,156	1,277,689
Northern shoveler	10,136	127,599	42,988	330,612	103,221	84	0	614,639
Mottled duck[3]	6,595	161,326	89,961	169,544	217,642	397	601	646,067
Canvasback	4,311	33,638	0	23,585	7,516	174	3,025	72,249
Redhead	392,650	92,944	402	0	13,731	0	0	499,727
Ring-necked duck	6,067	11,345	3,331	186,917	41,450	5,999	782	255,890
Greater & lesser scaup[4]	454,727	47,402	40,707	245,746	1,722,858	13,836	3,294	2,528,570
Total ducks	1,244,816	1,959,109	1,256,847	4,511,720	4,694,568	23,719	17,086	13,707,864
Lesser snow geese[3]	30,967	609,879	100,214	279,157	51,614			1,071,831
	25,766	737,403	117,555	437,841	72,250			1,390,815
Greater white-fronted geese[3]	7,759	97,636	7,457	62,529	0			175,381
	13,819	102,790	10,235	77,821	1,233			205,898
Canada geese[3]	6,155	63,043	996	2,000[5]	0			72,194
	430	12,768	957	1,052[5]	0			15,207
Total geese[3]	44,881	770,558	108,667	343,686	51,614	0	0	1,319,406
	40,015	852,961	128,747	516,714	73,483	0	0	1,611,920

[1] Objectives for ducks are based on 1970's winter distributions and breeding populations.
[2] Objectives for geese are based on 1982-88 averages of December Goose Surveys.
[3] Shaded values are "expected" numbers from 1994-97 (mottled ducks) or 1995-97 (geese) estimates.
[4] Scaup objectives exclude offshore populations.
[5] January ground counts indicate historical (1986-89) and recent (1996-98) averages of 5,273 and 10,267, respectively.

NAWMP continental breeding population goals, which total 62 million and are based on averages of 1970's breeding population surveys with adjustments for birds in nonsurveyed areas. We then estimated from nationwide midwinter survey data proportions, the numbers of those 62 million breeding ducks that should return on spring flights from the Mississippi and Central Flyway wintering areas; we adjusted those numbers for 10% January-to-May mortality to obtain midwinter goals for the Mississippi and Central Flyways. Finally, using 1970's midwinter survey data proportions from the Mississippi and Central Flyways, we calculated how much of each of the two flyway goals should be derived from each GCJV Initiative area. Figure 3 provides an example of how this general process was applied at the species level in the Mobile Bay Initiative area. Exceptions to this methodology include derivation of blue-winged teal and redhead objectives and the expected number of mottled ducks (see Derivation of GCJV Waterfowl Objectives and Migration Patterns section, p. 23).

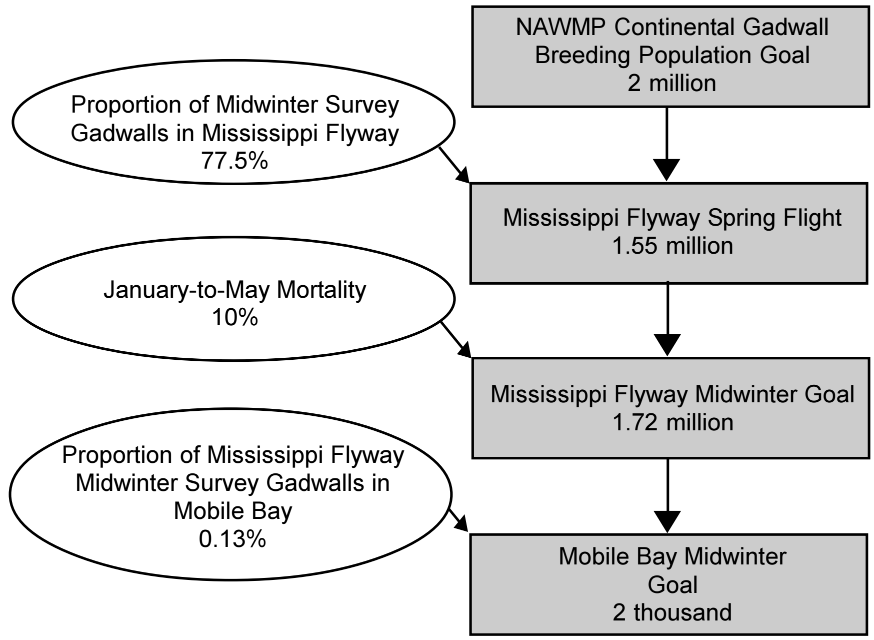


Figure 3. An example of how midwinter population objectives for a specific species, in this case gadwalls, were obtained in the Mobile Bay Initiative area.

Migration Chronology

Midwinter populations do not adequately represent the peak, or even the typical numbers of some waterfowl species common to the GCJV region. Because of the variety of GCJV waterfowl and the interspecific variability in their migration patterns, incorporating species-specific migration patterns into population objectives is appropriate. Migrations differ regionally, even for the same species, so migration patterns were determined separately for each initiative area (see Migration Chronology for Waterfowl Species of GCJV Initiative Areas section, p. 26). Combining migration patterns and midwinter duck objectives (see Derivation of GCJV Waterfowl Objectives and Migration Patterns section, p. 23) yields semimonthly population objectives by species (Fig. 4).

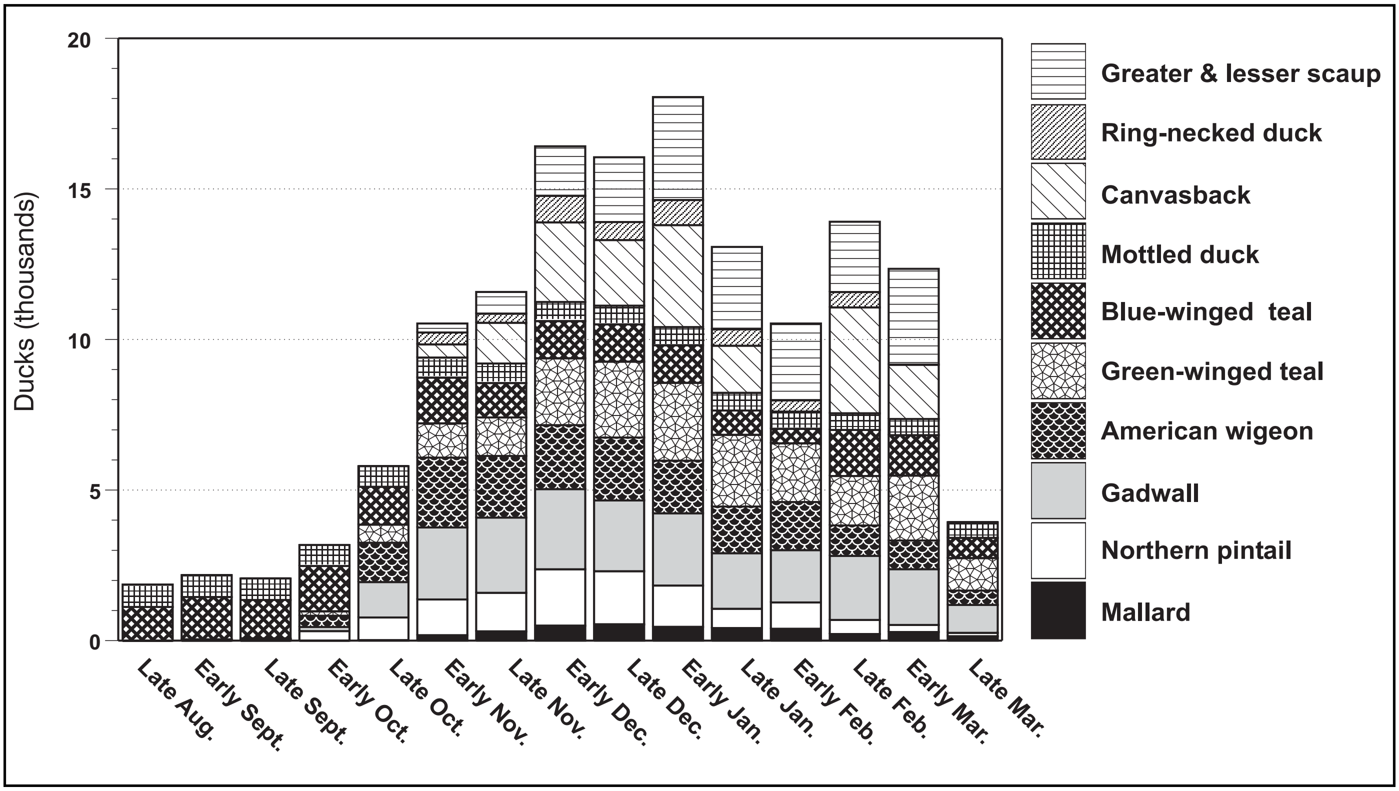


Figure 4. Semimonthly duck population objectives for the Mobile Bay Initiative area.

The Mobile Bay Initiative Area

The Mobile Bay Initiative area includes Mobile and Baldwin Counties along the Alabama coast and extends eastward from the Mississippi–Alabama border to Perdido Bay on the Alabama–Florida border and inland (Fig 2.) The initiative area encompasses a total land area of 2,830 square miles or 1.8 million acres and is comprised of a variety of land types. It consists of large bay and estuary systems that are nearly isolated from the Gulf of Mexico by barrier islands or peninsulas. Most notably within the initiative area, Mobile Bay is the sixth largest drainage basin in the United States and receives drainage from almost two-thirds of Alabama and portions of Georgia, Mississippi, and Tennessee. The Bay extends over roughly 400 square miles and ends at the Gulf Shores–Fort Morgan Peninsula and Dauphin Island. Another important land type within the initiative area is the extensive forested wetlands (approximately 100,000 acres) located in the Mobile–Tensaw River Delta (at the confluence of the Alabama and Tombigbee Rivers and extending southward 45 miles to the head of Mobile Bay).

Although the Mobile Bay Initiative area consists of a variety of wildlife habitats, this plan focuses on the three major waterfowl habitats available, coastal marshes (emergent vegetated wetlands), submerged aquatic vegetation, and forested wetlands.

Coastal Marsh

Marshes in the Mobile Bay Initiative area are less extensive than the great delta marshes of southeast Louisiana and the "chenier" marshes of southwest Louisiana and southeast Texas that are associated with stranded beach ridges. The marshes here tend to be dominated by palustrine systems of emergent grasses and flood tolerant herbaceous vegetation. Coastal marshes of the Mobile Bay Initiative area can be divided into two general types based on plant species composition, which is primarily influenced by species tolerance to water salinity. These two marsh type classifications are estuarine and fresh. In addition to associations of plant species, each coastal marsh type has characteristic hydrological patterns, soils, and fish and wildlife resources.

Types of Coastal Marsh

Estuarine Marsh

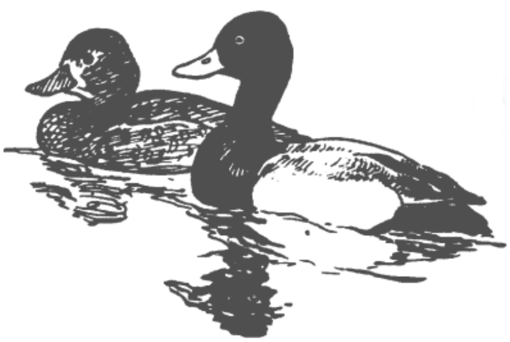
Estuarine marshes occur throughout portions of lower Mobile Bay. This marsh type includes saline, brackish, and intermediate marshes. Tidal fluctuation is variable, and water salinity ranges from 3.3 to 18 parts per thousand (ppt), resulting in numerous plant species. This marsh type is dominated by needlegrass rush, smooth cordgrass, marshhay cordgrass, seashore saltgrass, Olney bulrush, and common reed. The value of estuarine marshes to waterfowl lies in the buffering effect it has on the impacts of tide and salinity on the more desired fresh marshes farther inland. In addition, this marsh type provides year-round habitat for mottled ducks.

Fresh Marsh

Fresh marshes in the Mobile Bay Initiative area occupy large expanses of the Mobile–Tensaw River Delta. Of

Mallard pair.

the entire Delta, fresh marshes account for approximately 9.2% of the wetland acreage (10,589 acres; Stout et al. 1982). This marsh type is normally free of tidal influence but susceptible to periodic floods from heavy precipitation. Water salinity levels average only 1.0 ppt and drainage is slow. Fresh marsh supports the greatest plant diversity. Fresh marshes provide feeding and resting habitat for numerous species of ducks and are considered to be the most valuable marsh type to wintering waterfowl.



Scaup pair.

Within the Delta, freshwater marshes can be divided into low marsh and high marsh classifications. These subdivisions reflect differences in elevation, water levels, and plant communities (Stout et al. 1982). Low marshes are found occupying shallow flats in the large bays and on gently sloping shores of slower moving waterways. This habitat zone is frequently flooded but not on a predictable schedule. An inventory of wetland habitats in the Delta was completed in 1981 and 1982. Stout et al. (1982) reported that sedges, grasses, and rushes are often the dominant vegetation of low marsh, including panicgrass, annual wildrice, sawgrass, beak rushes, spikerushes, flatsedges, and rushes. Occasionally, other plants such as alligatorweed, bulltongue arrowhead, or cattail are dominant in isolated patches.

High marsh may occur as a continuous zone of marsh between the low marsh and higher forested wetlands. As sediment accretes in low marsh, elevation rises slightly and the marsh becomes dominated by less flood-tolerant herbaceous species (Stout et al. 1982). Dominant vegetation in this zone consists of grasses or sedges including common reed, cordgrass, and switchgrass (Stout et al. 1982).

Status and Trends

Although physical and biological characteristics of coastal habitats are continually altered by complex natural processes, the consequences of these processes are controlled by shoreline characteristics. For example, the sloping coastline situated along the Gulf of Mexico is heavily affected by even slight fluctuations in water levels (Ruple 1993). However, growth and deterioration of coastal wetlands have been naturally occurring in this region for thousands of years. As wetlands were degraded, their loss was balanced by natural wetland building processes. The most extensive marsh zone within the initiative area is located at the terminus of the Mobile–Tensaw River Delta (i.e., northern end of Mobile Bay). This area is dominated by fresh marshes and encompasses approximately 10,589 acres (Stout et al. 1982). Other marshes along the Mississippi Sound, Mobile Bay, and Perdido Bay are mostly narrow margins that serve as wetland buffers. Estuarine marshes (3,300 acres) dominated by smooth cordgrass and needlegrass rush occur only in lower Mobile Bay (Stout 1979). The distribution of remaining marshes in lower Mobile Bay is influenced by freshwater inflow (200 acres of fresh marsh).

Over half of the coastal wetlands for the entire conterminous United States are in the Gulf of Mexico region. However, coastal wetlands in Alabama account for less than 1% of the regional total (NOAA 1991). Over the past 5 decades, Alabama coastal wetlands have shown decreasing trends. For instance, emergent marsh habitat in upper Mobile Bay declined by more than 6,680 acres (or 35%) between 1955 and 1979 (Roach et al. 1987). During that time, freshwater marshes in all of coastal Alabama declined by about 69% (more than 6,200 acres).

Coastal erosion and wetland loss are increasingly serious problems that threaten the survival of Gulf coastal ecosystems. D.L. Ruple (1993) has estimated that approximately half of the Gulf of Mexico shoreline is seriously eroding and remains one of the major factors threatening Gulf coastal environments. The rate of erosion along the Alabama shoreline, including the northern portion of the Mississippi Sound, the western portion of Mobile Bay, and Bon Secour Bay, has been calculated at 7 ft/yr (Ruple 1993). There have been lesser erosion rates reported in other estuarine areas, but erosion rates have also been reported to be as high as 11 ft/yr (Smith 1989).

Wetland Loss Factors and Threats

In general, both humans and natural occurrences affect the coast. Human activities such as ship traffic, dredging, pollution, and development that modify and disturb the coastal environment can cause erosion and subsequently wetland decline and/or loss. The natural processes of subsidence and sea-level rise can also contribute to marsh deterioration and loss and in some cases have probably been exacerbated by human intervention.

Subsidence is the fate of delta marshes caused by compaction of sediments beneath their own weight. When hydrologic alterations affect natural sediment deposition necessary to offset subsidence, these wetlands sink beneath the water, resulting in deterioration of wetland habitats. Sea-level rise can hasten wetland subsidence and result in more open water acreage.

Preliminary data from selected coastal areas studied in the mid-1990's show a reduced rate of wetland loss compared with earlier decades (Watzin et al. 1995). For upper Mobile Bay, no additional net loss of nonfreshwater marsh has occurred since 1979. Some marsh has obviously been lost in certain areas, primarily because of dredge disposal associated with navigation and industry. These losses seem to have been offset by the growth of emergent marsh in existing spoil sites. However, the general consensus is that a slow, steady loss of wetland habitat is occurring within the Mobile Bay Initiative area. Palustrine (freshwater) wetlands are the most threatened of all types of Alabama coastal wetlands (Hefner et al. 1994). Emergent intertidal marshes of the mid- and lower coasts are among Alabama's most threatened estuarine habitats. Causes of decline include filling activities that cover wetlands, dredging activities that remove vegetation, and high concentrations of suspended particulate loads in bay waters that limit light penetration (Watzin et al. 1995).

Mottled duck pair.

Submerged Aquatic Vegetation

Communities of submerged aquatic vegetation (SAV) are important components of many freshwater, brackish, and marine aquatic ecosystems within the Mobile Bay Initiative area. These aquatic plant communities remove nutrients and other pollutants from river and runoff inputs to coastal areas, preventing their entry into surrounding waters. In addition, SAV provides nursery habitat for commercially important finfish and shellfish, as well as forage for wintering waterfowl. Submerged aquatic vegetation beds exist in isolated patches and narrow bands within the initiative area, primarily in the subtidal zone with some extending into the intertidal zone. Salinity, water depth, water clarity, and substrate are the dominant mechanisms affecting SAV distribution.

Two species of SAV, Eurasian watermilfoil and wildcelery are common within the Mobile Bay Initiative area (Zolczynski and Shearer 1997). Canvasbacks and puddle ducks that winter along the Alabama coast forage extensively in SAV beds. One of the largest wintering canvasback populations in the Mississippi Flyway, outside of Louisiana, uses Mobile Bay. In addition, small patches of widgeongrass have recently been observed in the southern portion of Mobile Bay (Stout 1998). Widgeongrass serves as a quality food item for a variety of puddle duck species including Northern pintail, gadwall, and American wigeon.

Lesser snow geese.

Submerged Aquatic Vegetation Status and Threats

Based on current estimates (NOAA 1997), spatial coverage of SAV in the Gulf of Mexico is equivalent to 12-24% of the estuarine area. Losses of SAV in the northern Gulf of Mexico over the last 50 years have been large—from 20% to 100% for most estuaries (Handley 1995). Most of the SAV loss is attributed to coastal population growth and accompanying municipal, industrial, and agricultural development. The total SAV coverage in the shallow waters of protected gulf estuaries is estimated to be 800,000 acres, with about 95% occurring in the estuarine areas of Florida and Texas (Duke and Kruczynski 1992).

In the Mobile Bay Initiative area, there are approximately 12,280 acres of submerged aquatics (Mobile–Tensaw River Delta [11,680 acres] and Perdido Bay [600 acres]); however, this tends to be an underestimate for the initiative area since only visible beds were measured (Stout 1998). Another problem with the estimates is that most of the surveys were conducted in the Mobile–Tensaw River Delta and just south of the U.S. 98 Causeway with very little assessment of SAV distribution in the lower portion of Mobile Bay (Stout 1998). Nevertheless, the most abundant species was Eurasian watermilfoil, which was dominant in 4,579 acres of SAV. The second most abundant species was wildcelery, which was dominant in 3,207 acres of SAV (Zolczynski and Shearer 1997). In comparison with earlier studies, a significant increase in SAV distribution can be seen throughout the Mobile–Tensaw River Delta. This is primarily due to the gradual recovery of native SAV species and rampant growth of exotic species (i.e., Eurasian watermilfoil and hydrilla) in Grand Bay, Chocolatta Bay, Polecat Bay, D'Olive Bay, and south of the U.S. 98 Causeway (Zolczynski and Shearer 1997).

In Perdido Bay, widgeongrass and shoalgrass are the dominant species. They grow in various size beds along shallow sandy reaches of the shoreline. From 1940 to 1987, coverage of submerged aquatics in Perdido Bay declined from 1,201 acres to 619 acres, a reduction of nearly 48% (Handley 1995). The reduction is due to increased turbidity caused primarily by channel dredging, boating activities, and shoreline development.

Hurricanes, cold-front storms, and increased or decreased salinities are natural causes of SAV loss and cannot be controlled. The loss of SAV beds is also attributable to human-induced effects associated with residential and industrial development pressures. Submerged aquatic vegetation meadows are susceptible to adverse effects of filling in two ways: (1) from direct impacts of filling and (2) from indirect impacts of filling which include the production of suspended material in the water column (i.e., turbidity). Excess nutrients from sewage treatment discharges, septic systems, and drainage from agricultural fields (i.e., water quality) can stimulate growth of phytoplankton in the waters over the grass beds. Submerged aquatic vegetation beds are often damaged by propellers and boat anchors from shallow draft recreational boats. Propeller scarring may contribute to additional degradation of SAV beds by accelerating erosion near broken root mats.

Forested Wetlands

Forested wetland ecosystems are an important waterfowl habitat component within the Mobile Bay Initiative area. These wetlands are among the most productive natural ecosystems in the world. In their natural condition, forested wetlands provide many benefits including food and habitat for fish and wildlife, flood protection, erosion control, and ground water exchange. In addition, forested wetlands help maintain and improve water quality by intercepting surface water runoff, removing or retaining nutrients (e.g., nitrogen and phosphorus), processing chemical and organic wastes, and reducing sediment loads downstream. However, the loss or degradation of these wetlands can lead to serious consequences including habitat fragmentation, species decline, increased frequency of flooding, and declines in water quality.

The Mobile–Tensaw River Delta located at the northern end of the initiative area consists of approximately 115,100 acres of wetland habitats dominated by forested swamps and seasonally flooded bottomland hardwoods. This ecosystem comprises over 100,800 acres (87%) of forested wetlands (Stout et al. 1982). This extensive area of forested wetlands attracts numerous species of wintering waterfowl. Wood ducks are the primary species of ducks using the Delta. Other dabbling ducks use these habitats to a lesser degree.

Forested Vegetative Communities

This region is composed primarily of three vegetative communities: deep alluvial swamp, alluvial swamp, and natural levee. These three habitat types account for 95% (95,831 acres) of forested wetlands that occur throughout the Delta (Stout et al. 1982).

Deep Alluvial Swamp

Swamps of this type make up 35% (35,301 acres) of the forested wetlands in the Delta and occupy portions of the floodplain, which are deeply flooded for prolonged periods (Stout et al. 1982). Areas where flooding is relatively constant are dominated exclusively by bald cypress and water tupelo. Even slight variations in soil characteristics, topography, or drainage may produce marked changes in species composition of these areas. As the depth and duration of surface flooding decreases, additional tree species may appear including red maple, laurel oak, swamp tupelo, green ash, sweetgum, and swamp cottonwood (Stout et al. 1982).

Alluvial Swamp

Alluvial swamps are dominated by areas of low relief that are subjected to only short periods of seasonal flooding. Within the Mobile–Tensaw River Delta, this habitat type makes up 34% (33,966 acres) of forested wetlands (Stout et al. 1982). A mixture of relatively flood tolerant species exists in alluvial swamp including swamp tupelo, red maple, green ash, swamp cottonwood, and overcup oak. In addition, extremely flood tolerant species, such as bald cypress and water tupelo can be found (Stout et al. 1982).

Natural Levee

Late winter and early spring are typically periods of highest river flow. As rivers exceed their banks and begin to spread across the floodplain, current velocities slacken and deposit coarse sediments adjacent to the river channel. Due to higher elevations and improved drainage, these natural levees provide suitable habitat for the establishment of moderately flood tolerant tree species and comprise 26% (26,564 acres) of forested wetlands in the Mobile–Tensaw Delta (Stout et al. 1982). The canopy consists of deciduous hardwoods including water hickory, sugar hackberry, American elm, sweetgum, water oak, willow oak, and overcup oak (Stout et al. 1982).

Wetland Loss Factors and Threats

From the mid-1970’s to the mid-1980’s, forested wetlands such as bottomland hardwood swamps and cypress sloughs declined by 3.1 million acres in the Southeast. In Alabama, the net loss of palustrine forested wetlands was estimated to be 42,000 acres. The principal cause of the net wetland loss was agriculture (Hefner et al. 1994). However, within the Mobile–Tensaw River Delta only 1,200 acres of forested wetlands were lost between 1979 and 1988 (Watzin et al. 1995). The primary causes of forested wetland loss in the extreme upper end of the Mobile Bay Initiative area can be attributed to conversion of forested habitats to scrub-shrub areas (e.g., clear-cutting associated with timber harvest) and commercial/residential development.

The Mobile Bay Initiative Implementation Plan

Habitat conservation is imperative for meeting waterfowl population objectives of both the NAWMP and the GCJV. The critical habitat conservation needs on public and private lands of the GCJV are to stop and reverse the deterioration and loss of wetlands, especially coastal marshes, and to improve the waterfowl value of agricultural lands. Loss of coastal marsh can be addressed by actions that reduce the rate of loss or that build land. The Mobile Bay Initiative is unique within the GCJV initiative areas in that forested wetlands are the dominant habitat type of importance to regional waterfowl populations. Actions addressing the management of forested wetlands will be based largely on restoration of degraded habitat and implementation of sound silvicultural practices.

The availability of food resources is the most likely effect of winter habitat on survival and recruitment of waterfowl populations. Availability of food can be affected by production of foods (submerged aquatics, annual seeds, hard mast, or invertebrates), flooding at appropriate times and depths for foraging, and access to food influenced by floating exotics, disturbance, or other factors. In addition to fall and winter food resources, mottled duck populations are also influenced by breeding and postbreeding habitat along Alabama's coastal wetlands. Availability of fresh or intermediate shallow water in brood-rearing and molting areas is critical during the spring and summer. Therefore, the habitat conservation actions outlined in this plan intend to influence one or more of these habitat parameters.

Conservation Strategies

Two broad strategies of wetland conservation are important to achieving the goals and objectives of the Mobile Bay Initiative area. These strategies are maintenance (i.e., loss prevention) and restoration of wetland habitat. Though not a strategy, routine management activities are important and inherent components of the maintenance and restoration strategies. Conservation actions under both of these strategies take several forms. The types of wetland conservation actions identified in each initiative area reflect the differences previously discussed that characterize each area. Descriptions of the strategies applicable to the Mobile Bay Initiative area are presented below.

Maintenance of Habitat

Maintenance involves preserving existing functions and values of the habitat. The intent is to prevent additional loss and degradation of wetlands, particularly in remaining SAV beds and coastal marshes that are most vulnerable to erosion or conversion to more saline types through saltwater intrusion. Examples of conservation actions under this strategy include the following:

(1) planting erosion control vegetation at key points protecting the hydrologic integrity of vulnerable marshes;

(2) implementing managed fire and herbicide applications to maintain vegetative communities susceptible to invasion by woody exotics and common reed;

(3) controlling floating or submersed exotic vegetation to maintain natural plant communities;

Erosion control vegetation.

Marsh burning.

(4) promoting education about the importance of SAV including the impact of prop scars and shrimp net scars on SAV distribution and the resulting fishery harvests;
(5) installing signs and channel markers around SAV beds to avoid mechanical damage from recreational boating activities;
(6) implementing forest management plans that maintain the integrity and historical resource values of this ecosystem;
(7) maintaining existence of natural beaver-induced impoundments by managing beaver pond water levels in a manner acceptable to landowners;
(8) implementing measures to control the rapid expansion of feral pigs in the delta, thus maintaining native plant communities;
(9) providing technical guidance to achieve the above maintenance measures; and
(10) securing vulnerable marsh tracts through fee title acquisition, conservation easements, or management agreement for implementing the above maintenance measures.

Restoration of Habitat

Restoration involves conservation actions necessary to re-establish a naturally occurring but degraded wetland ecosystem. The goal is to restore or mimic the original wetland functions and values of the site. Examples of conservation actions under this strategy include the following:

(1) restoring water quality and subsequent SAV productivity by reducing fetch and turbidity;
(2) conducting floating or submersed exotic vegetation control to restore natural plant communities;
(3) planting submerged aquatic plants in areas that historically supported SAV beds;
(4) implementing managed fire and herbicide applications to restore vegetative communities altered by woody exotics and common reed;
(5) working with the U.S. Army Corps of Engineers to modify dam releases on rivers that flow through the Mobile–Tensaw Delta so that historical patterns of seasonal hydrology are mimicked,
(6) restoring historic hydrology to degraded bottomland hardwood habitats by plugging internal logging canals;
(7) reforesting log-loading deck sites to return native mast bearing hardwoods to where they once existed naturally;
(8) implementing forestry improvements by manipulating timber stands composed of cottonwood, ash, and red maple to more closely resemble natural bottomland hardwoods;
(9) supporting studies that evaluate the economic, social, and environmental impacts of plans to restore tidal exchange between water-bodies north of U.S. 98 Causeway and Mobile Bay by replacing sections of the causeway with bridges;
(10) manipulating previously disposed dredge material to more closely mimic natural wetland conditions;

(11) providing technical guidance to achieve restoration measures; and

(12) securing degraded marsh tracts through fee title acquisition, conservation easement, or management agreement for the purpose of implementing the above restoration measures.

Habitat Objectives

The three major waterfowl habitats available in the Mobile Bay Initiative area are coastal marshes, SAV beds, and forested wetlands. Habitat objectives are based on the assumption that food availability is the most likely limiting factor for ducks wintering in the GCJV. Food availability is potentially influenced by factors that affect food production (e.g., marsh health, silviculture practices, etc.) and access (e.g., disturbance, water at appropriate depths, etc.).

Coastal Marsh Habitats and Submerged Aquatic Vegetation

Food density data are not available for coastal marshes and SAV beds of the Mobile Bay Initiative area, precluding quantitative modeling of habitat needs. However, we are able to quantify the energetic demands of waterfowl in these habitats. Based on food habits research and general knowledge of habitat use by various species, we estimated the proportion of each species' foraging needs that we should provide for in nonforested habitats to be 90% for mottled ducks, blue-winged teal, canvasbacks, ring-necked ducks, and scaup and 75% for Northern pintails, gadwalls, American wigeons, and green-winged teal. These estimates result in habitat population objectives for the nonforested portion of the Mobile Bay Initiative area (Fig. 5).

We modeled the waterfowl energy demand for this portion of our population objectives based on the dietary energy supply necessary to sustain them. Researchers estimate energetic requirements of mallards to be 290 kcal per day (Petrie 1994), with other species having energetic needs in proportion to their body weight (Kendeigh 1970). We therefore used average body weights of each species in conjunction with semimonthly population objectives to arrive at an energy demand curve, in terms of mallard-use-days, through the wintering waterfowl period (Fig. 6).

We lack sufficient information to convert this energy demand to nonforested habitat acres. However, given the importance of this habitat and its food resources to waterfowl, the loss and continued threats to both habitats, and the limited opportunities for restoration and maintenance, the GCJV supports all projects that seek to restore lost or degraded marshes and SAV beds to sustainable historic or more natural conditions. Additionally, the GCJV supports all protective measures that maintain current habitat values that would otherwise be predictably lost.

Forested Wetland

Estimates are available for the density of desirable mast for waterfowl in forested wetland habitats, so we can model the waterfowl habitat requirements for that particular habitat. Based on food habits research and general knowledge of habitat use by various species, we estimated the proportion of each species' energetic needs in these forested wetland habitats to be 100% for mallards and wood ducks, 25% for Northern pintails, gadwalls, American

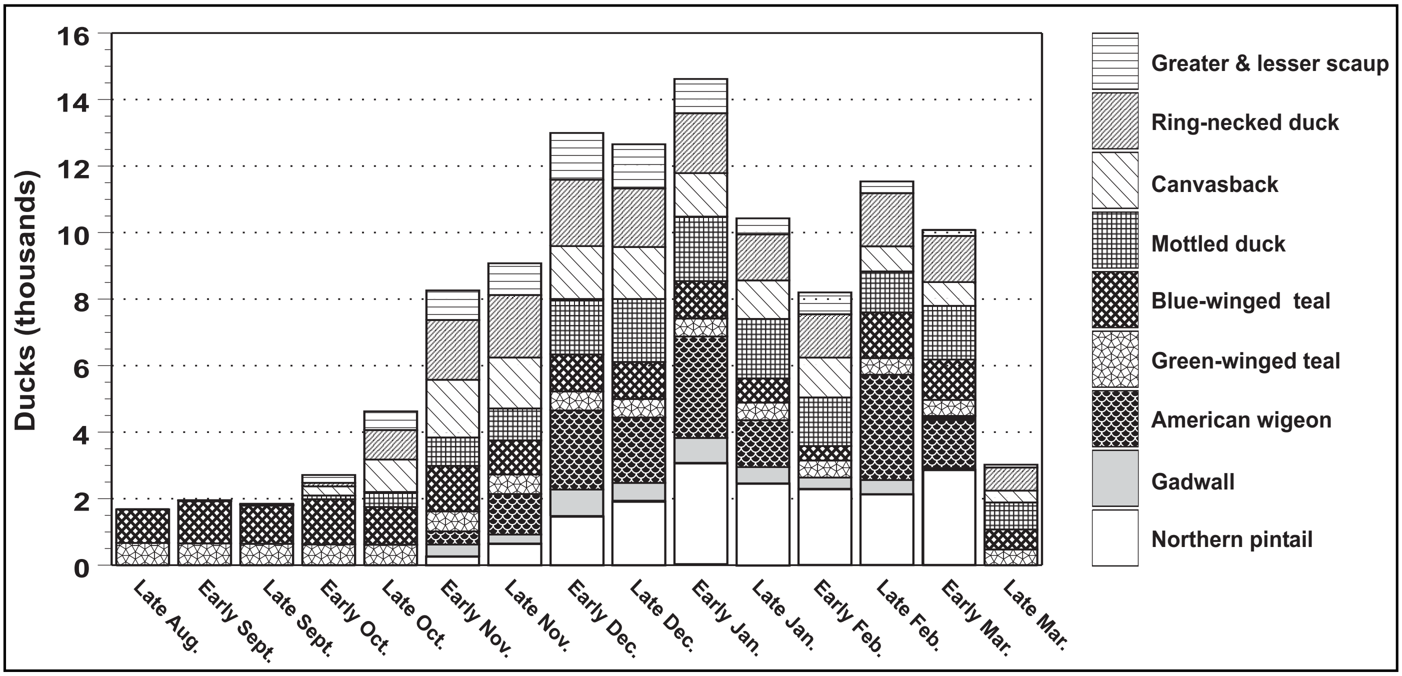


Figure 5. Semimonthly duck population objectives for coastal marsh and submerged aquatic habitats within the Mobile Bay Initiative area.

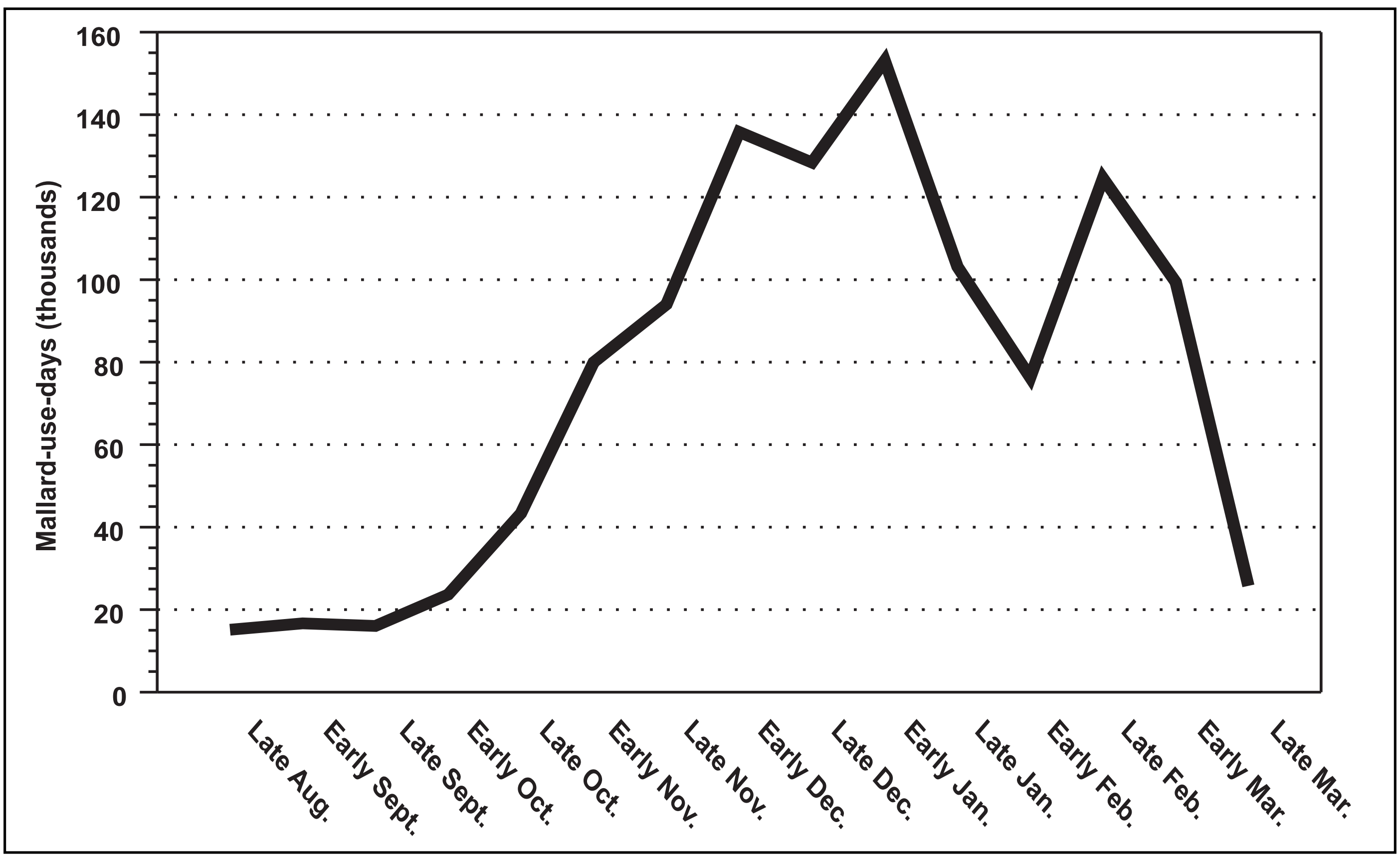


Figure 6. Energetic demands of duck objectives (mallard-use-days) in coastal marsh and submerged aquatic habitats within the Mobile Bay Initiative area.

wigeons, and green-winged teal and 10% for mottled ducks, blue-winged teal, canvasbacks, ring-necked ducks, and greater and lesser scaup. We used recent estimates of waterfowl harvest to determine the expected number of wood ducks for Mobile and Baldwin Counties (see Derivation of GCJV Waterfowl Objectives and Migration Patterns section, p. 23), thus resulting in estimates of waterfowl population demand on forested wetland habitats within the Mobile Bay Initiative area (Fig. 7).

Again, we modeled the waterfowl energetic demand for this portion of our population objectives based on the dietary energy requirements of mallards (Petrie 1994), with other species having energetic needs in proportion to their body weight (Kendeigh 1970). We arrived at an energy demand curve, in terms of mallard-use-days, through the wintering waterfowl period (Fig. 8).

During a typical year, over 100,000 acres of forested wetland habitat is available as foraging habitat for migrating and wintering waterfowl in the Mobile–Tensaw River Delta (James Masek, Alabama Division of Wildlife and Freshwater Fisheries, pers. comm.). Red oak species make up approximately 5-10% of bottomland hardwood stands. Estimated densities of bottomland hardwood mast crops

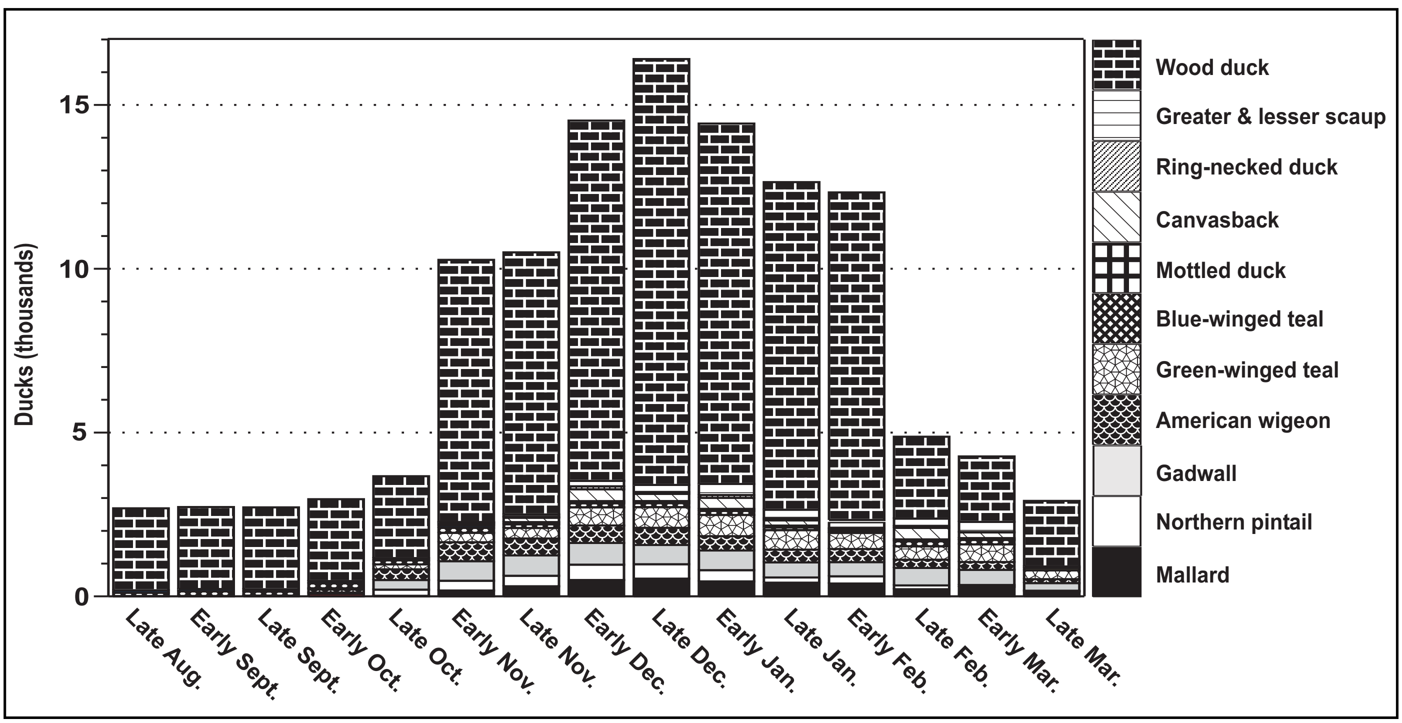


Figure 7. Semimonthly duck population objectives for forested wetland habitats within the Mobile Bay Initiative area.

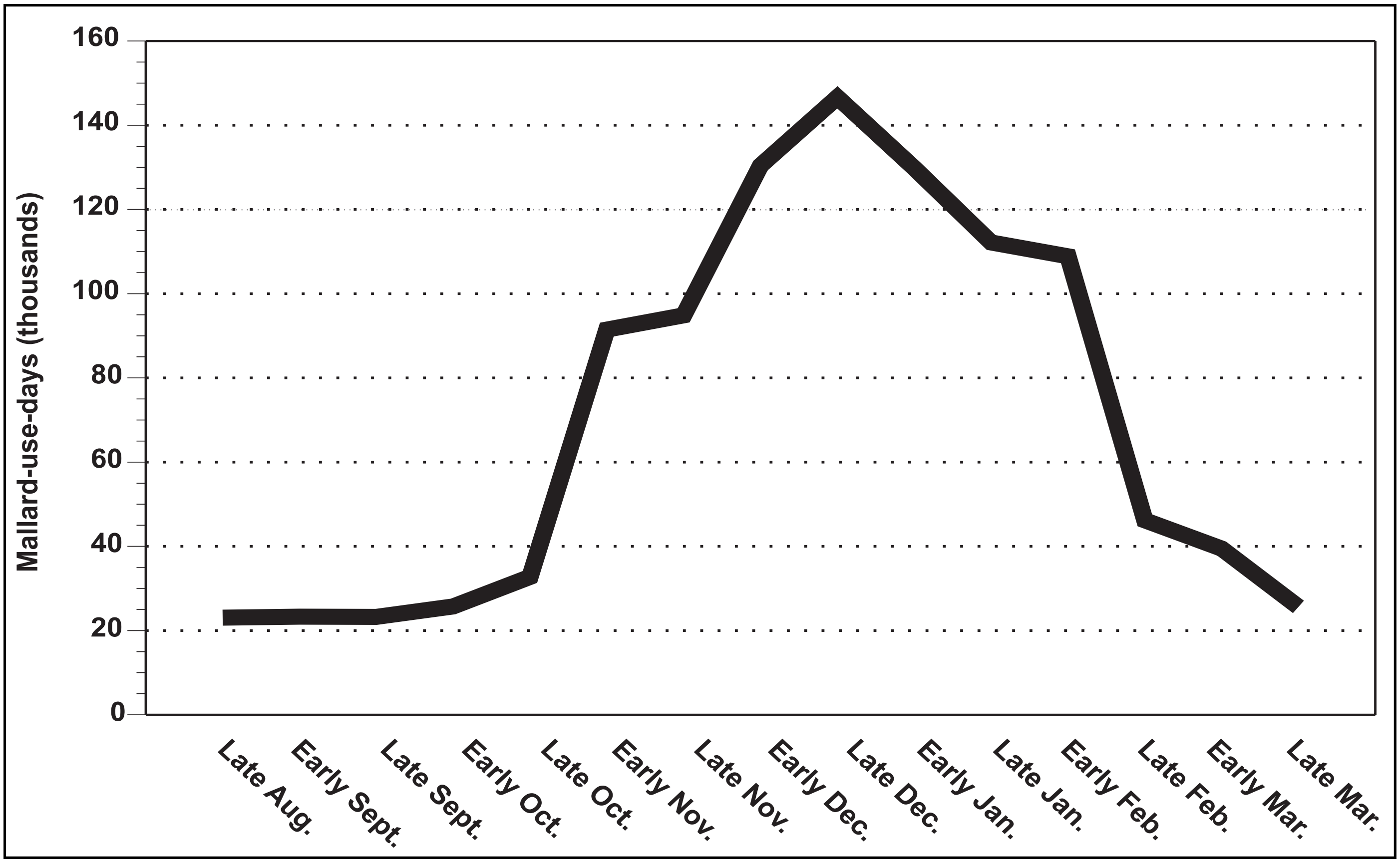


Figure 8. Energetic demands of duck objectives (mallard-use-days) in forested wetland habitats within the Mobile Bay Initiative area.

have been published for the Lower Mississippi Valley Joint Venture area (Loesch et al. 1994). We assumed the relationship between percent red oaks and waterfowl foraging values in bottomland hardwood stands would be similar to the Mobile Bay Initiative area (Table 2). Using these values, we modeled habitat objectives throughout the Mobile Bay Initiative area. These assumptions, combined with habitat acreages, yield rough estimates for foraging habitat objectives in the Mobile Bay Initiative area (Table 2).

Habitat Conclusions

Forested wetlands of the Mobile Bay Initiative area provide habitat for roughly half of all waterfowl, including wood ducks, that occur in the region. Fortunately, state and federal conservation agencies have permanently secured a large portion of the available forested wetland acreage in the region for the benefit of waterfowl and the myriad of other wildlife that rely on that habitat (Table 3). Consequently, the foraging needs of Mobile Bay Initiative area waterfowl that use forested wetlands can be entirely met by the tracts of land already in public ownership. Protection and acquisition of additional forested wetland habitat solely to meet NAWMP goals and objectives is therefore not warranted;

Table 2. Foraging values, habitat needs, and habitat availability for the Mobile Bay Initiative area.

	Foraging values (MUDs[1])	Habitat need (MUDs)	Total available		Available in ADWFF[6] public ownership	
			acres	MUDs	acres	MUDs
Coastal marsh and submerged aquatic vegetation (SAV)	unknown	1,135,305[2]	26,369	unknown	22,869[5]	unknown
Forested wetlands	15.5	1,053,525[3]	100,800	1,562,400[4]	85,520	1,325,560
Total		2,188,830[3]	127,169	1,562,400+	108,389	1,325,560+

[1] MUD = Mallard-use-days.
[2] Sum of all energetic demands for coastal marsh and SAV habitats (Fig. 5).
[3] Sum of all energetic demands for forested wetland habitats (Fig. 7).
[4] Available foraging habitat in forested wetlands.
[5] This figure also includes state-owned water bottoms.
[6] ADWFF = Alabama Division of Wildlife and Freshwater Fisheries.

however, the needs of other wildlife species as outlined in their respective conservation plans (e.g., Partners in Flight) may warrant further protection of forested wetland habitats in this region. Intensive management on existing tracts seems the most logical approach to increase waterfowl use of the area. Management options in forested wetlands of the Mobile Bay Initiative area include hydrologic restoration, moist-soil management, bottomland hardwood reforestation, and timber stand improvements.

Coastal marsh and SAV of the Mobile Bay Initiative area provide habitat for nearly half of all waterfowl that occur in the region. We lack food density data for these habitats,

precluding a quantitative assessment of the carrying capacity of available coastal marsh and SAV habitats. Nonetheless, a significant portion of waterfowl wintering in the Mobile Bay Initiative area forage on submerged aquatic and emergent plants. Until we are able to quantify these food resources, a conservative approach to waterfowl management requires that we elevate conservation of marshes and SAV habitat to a high priority in the Mobile Bay Initiative.

Specific Activities

The wetland habitat objectives of the GCJV's Mobile Bay Initiative will be addressed through various projects that focus on coastal marsh, SAV, and forested wetlands. Coastal marsh projects will involve protecting critical shorelines and banks, and improving or restoring more natural hydrological conditions (e.g., evaluate modification of the U.S. 98 Causeway to increase tidal exchange after sufficient studies have been completed). Many of these projects will be designed to address localized problems while others will be designed to provide benefits to coastal wetlands far beyond the construction footprint. Conservation of submerged aquatics will concentrate on protecting existing SAV beds from mechanical damage, minimizing biological alterations due to dredging and dredge disposal, reducing competitive, nonnative SAV species, and restoring lost meadows. Projects on forested wetlands will involve hydrology restoration and timber stand management. Additionally, partners will initiate activities described in this document as other opportunities become available. An evolving package of actions designed to meet some of the Mobile Bay Initiative/GCJV objectives as well as contribute to the fulfillment of the NAWMP goals has been developed and will be continually updated.

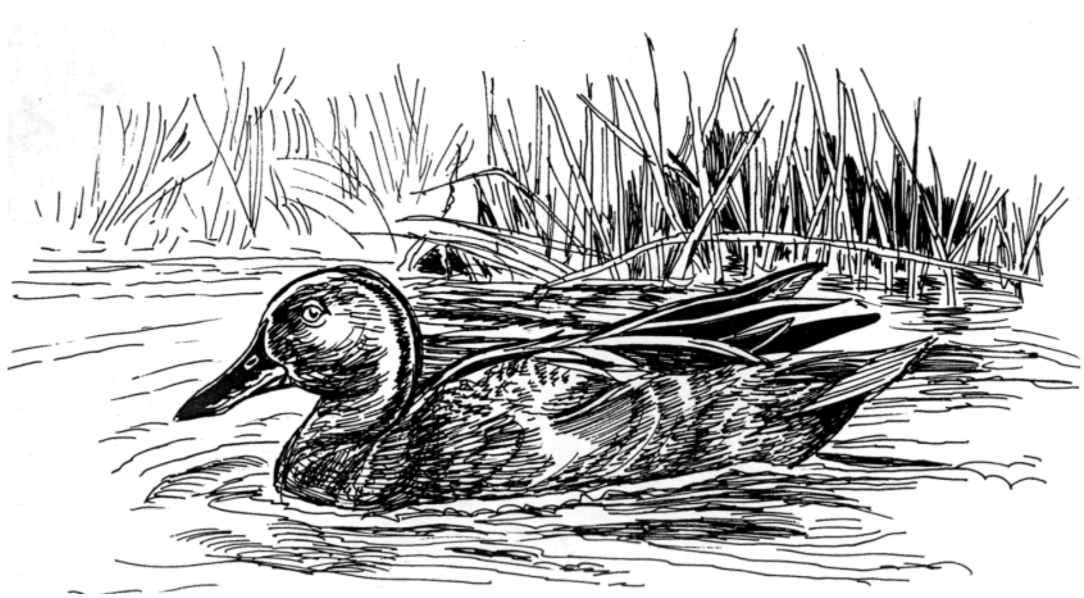
American wigeon pair.

Other Programs

We recognize and support other conservation efforts that contribute to the goals of this plan. The Wetland Reserve Program, administered by the Natural Resources Conservation Service (NRCS) of the U.S. Department of Agriculture, could improve conditions for waterfowl on drained wetlands, particularly in Baldwin County, Alabama. The primary factors limiting such restoration are urbanization and high land costs. With cooperation and support from the NRCS and other agencies (i.e., U.S. Fish and Wildlife Service, Alabama Division of Conservation and Natural Resources, and Ducks Unlimited), the Wetland Reserve Program could accomplish numerous restoration projects within the Mobile Bay Initiative area. Coastal marsh projects implemented under the Coastal Wetlands Planning, Protection and Restoration Act could possibly contribute to the maintenance and restoration objectives of this plan through the National Coastal Wetlands Conservation Grant Program. Implementation of new wetland projects can be achieved through Sections 1135, 204, and 206 of the 1986 Water Resources Development Act administered by the U.S. Army Corps of Engineers.

Communication and Education

Public awareness of the importance of the Gulf Coast to waterfowl and other renewable resources is key to the success of the GCJV. Communication efforts will be developed to educate decision makers, resource managers, landowners, conservation organizations, and the general public about wetlands conservation in the Mobile Bay Initiative area.



Relationship to Evaluation Plan

Objectives and strategies outlined in this document represent a compilation of the best available information regarding the habitat needs of waterfowl in this region. However, information gaps require numerous assumptions about both the basic framework for planning habitat conservation (i.e., food limitation) and specific variables used in energetic modeling of habitat needs (e.g., relative importance of habitat types by species). Testing of the most critical of these assumptions will be addressed in the GCJV Evaluation Plan, which is being developed simultaneously with this plan. The GCJV Evaluation Plan will provide a mechanism for feedback to, and refinement of, Initiative Area Implementation Plans. Initiative Area Implementation Plans will therefore be updated periodically, as evaluation feeds the planning and implementation processes.

Northern shovelers and blue-winged teal.

Midwinter Duck Population Objectives

Although the coordinated midwinter survey is an inaccurate count of total wintering birds, and not corrected for visibility bias, it provides a reasonable approximation of the relative distribution of birds across broad regional and temporal scales. Therefore, we used averages from the 1970-79 midwinter surveys for each species to determine the proportion of surveyed ducks that occurs in each of the initiative areas. (For greater and lesser scaup, offshore counts were excluded due to inconsistent survey coverage, resulting in "inland-only" scaup objectives.) We then applied those species-specific proportions to the NAWMP continental breeding population objectives for each species to arrive at the number of birds each initiative area should supply to the breeding population. We assume 10% mortality between midwinter (January) and breeding (May) periods to arrive at midwinter objectives (Table 1).

Using mallards as an example, during 1970-79, 42.9% of all continental mallards counted during the midwinter survey were in the Mississippi Flyway (see Fig. 3 for a similar example). The NAWMP continental breeding population objective for mallards is 11 million, so we estimate the portion of the continental breeding population objective from the Mississippi Flyway to be 42.9% of that, or 4.72 million. Expanding this number to account for 10% mortality between January and May yields a midwinter objective of 5.24 million in the Mississippi Flyway. Because 9.8% of all Mississippi Flyway mallards were counted in the Louisiana Chenier Plain, we applied that percentage to the flyway goal and obtained a midwinter population objective of about 516,000 for mallards in the Louisiana Chenier Plain. This method yields midwinter objectives for most species of ducks that commonly occur in the GCJV area (Table 1).

Exceptions to this method include derivations for blue-winged teal and redhead objectives, and estimation of the expected number of mottled ducks. For blue-winged teal, the continental breeding population was first reduced by 79% to account for the proportion estimated to winter outside the range of the U.S. midwinter survey, mainly in Mexico and both Central and South America.

Male ring-necked duck.

Population objectives for redheads were determined directly from average winter population estimates from the Special Redhead Cruise Survey for the same time period (1970-79). Using direct estimates from aerial winter surveys to determine objectives is appropriate for determining objectives for redheads but not other ducks, because (1) wintering redheads occur almost exclusively in known locations of offshore seagrass habitat with good visibility, (2) visibility bias has been estimated and found negligible for portions of this special survey, and (3) redhead habitats are not consistently surveyed during the midwinter survey, precluding the methodology applied for most species.

Male American wigeon.

To estimate the number of mottled ducks expected to occur during winter, we used mark-recapture analyses of direct recoveries from bandings in Louisiana and Texas during 1994-97. Preseason population estimates were derived from the assumption that the ratio of the total population to the total harvest (U.S. Fish and Wildlife Service estimate) equals the ratio of the banded population to the banded harvest (direct recoveries/band reporting rate estimate; band reporting rates are assumed to be 33% for 1994-95 and 59% for 1996-97). Preseason population estimates were then averaged, and an estimated fall/winter mortality rate of 30% was assumed to be evenly distributed September through March. The resulting midwinter estimate was then apportioned to initiative areas by the midwinter survey (Table 1).

Though not actually an objective, recent wood duck numbers are used in some initiative areas to augment energetic models depicting habitat needs in forested wetlands. These recent population size approximations are derived from a combination of harvest and harvest rate estimates. The Harvest Surveys Section of the U.S. Fish and Wildlife Service (Laurel, MD) provided wood duck harvest data by county for 1990-99. Wood duck harvest rates are approximated from recent band recovery rates and the band reporting rate is estimated to be about 10% (Table 4).

Table 4. Estimated wood duck harvest, harvest rates, and population size(s) for the Mobile Bay, Coastal Mississippi Wetlands, and Mississippi River Coastal Wetlands (southeast Louisiana) Initiatives.

Initiative area	Number harvested (10-yr average)	Harvest rate	Expected peak population
Mobile Bay	1,300	10%	13,000
Coastal Mississippi Wetlands[1]	530	10%	5,300
Mississippi River Coastal Wetlands (southeast Louisiana)	21,900	10%	219,000

[1]Due to low sample size, we used the upper range of harvest estimates from 1990-99.

Migration Patterns

Louisiana migration patterns for ducks were determined by using periodic coastwide aerial surveys along established transects that generally were flown one to two times per month September through March, 1970-98 (Louisiana Department of Wildlife and Fisheries coastal transect survey, unpublished data). Chandeleur Sound, the primary redhead area in Louisiana, is not covered by these coastal transects, so for Louisiana redheads we instead used 1987-92 periodic redhead surveys from that region (Thomas C. Michot, U.S. Geological Survey, unpublished data). Each survey was assigned to a half-month period. For each species, each survey of a given year was expressed as a proportion of that year's peak. These proportions were averaged across all years to yield the average proportion of the annual peak for each half-month period. All proportions were then expressed relative to the midwinter (January) proportion (see Migration Chronology for Waterfowl Species of GCJV Initiative Areas section, p. 26).

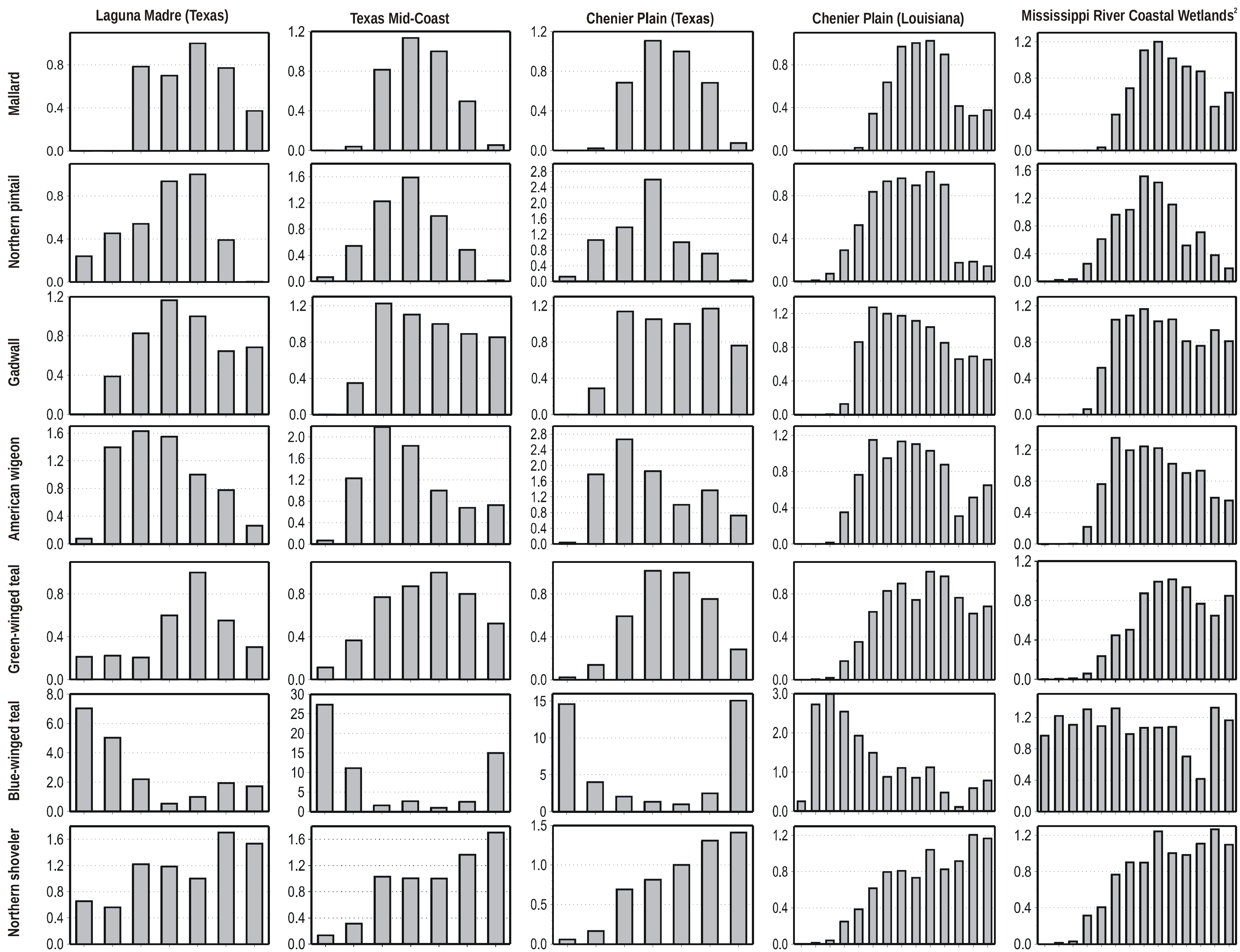
For Texas, aerial surveys of federal refuges and select other properties provide the basis for determining migration patterns (U.S. Fish and Wildlife Service's Coastal Waterfowl Survey Data, unpublished data). These monthly Texas surveys were conducted September through March of 1984-97, and data from all sites that were consistently surveyed within a given year were used. Analyses were conducted as above, except each survey represented an entire month (see Migration Chronology for Waterfowl Species of GCJV Initiative Areas section, p. 26).

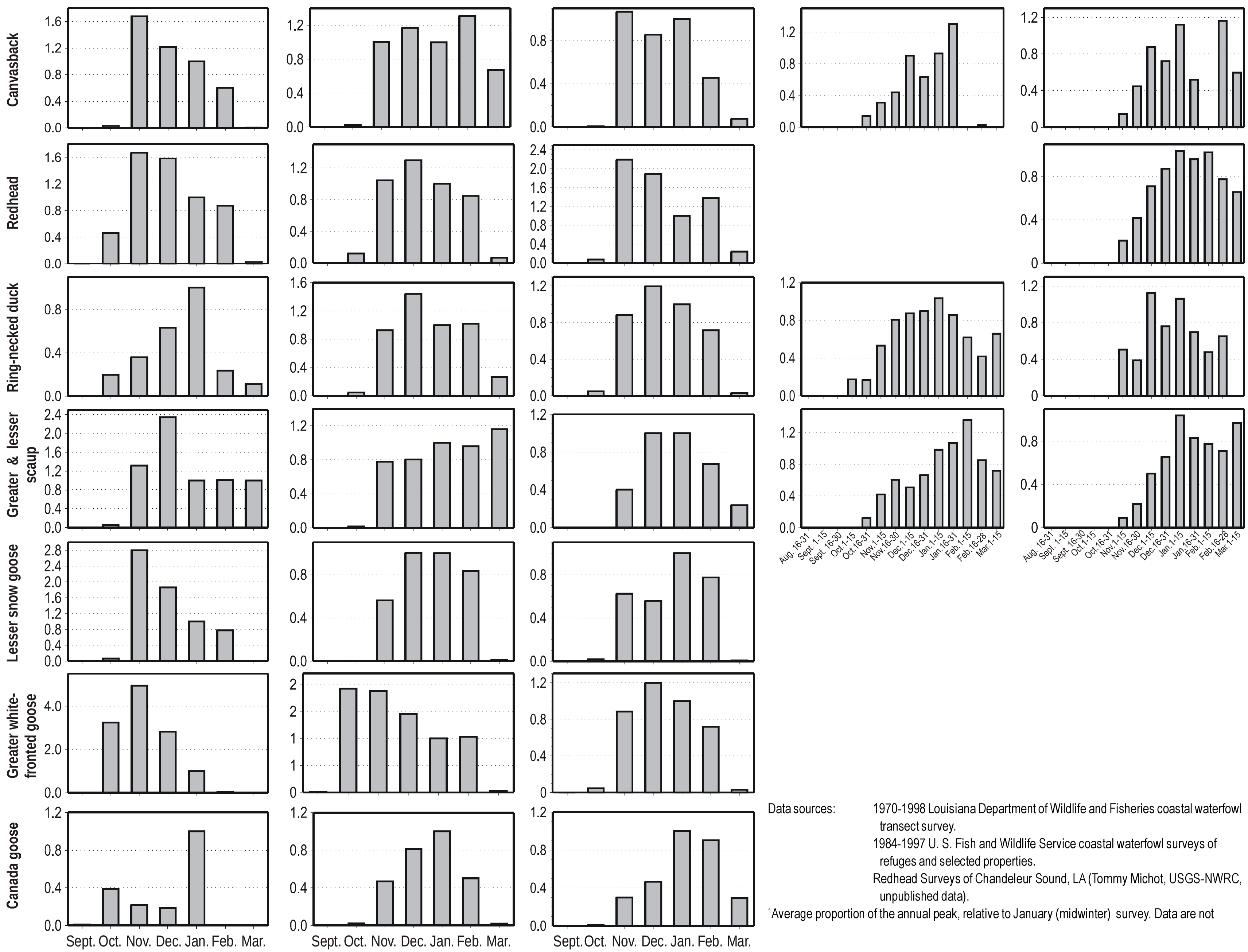
For wood ducks, we used fall and spring migration data depicted for the Gulf Coast in Bellrose and Holm (1994) to estimate the relative proportion of the annual peak in each semimonthly period.

Multiplying these semimonthly proportions by the midwinter population objectives yields semimonthly population objectives by species and initiative area (Figures 4 , 5, and 7). Because Louisiana surveys were never conducted in late March, we assumed late March values for all species were 50% of early March values. Because Texas surveys were never conducted in late August, we assumed late August blue-winged teal values were 15% of early September values. Because geese are not periodically surveyed in Louisiana, we applied migrational information from the Texas Chenier Plain to all eastward initiative areas. For the Coastal Mississippi Wetlands and Mobile Bay Initiative areas, we applied duck migrational information from the Mississippi River Coastal Wetlands Initiative area (southeast Louisiana).

Blue-winged teal males.

Migration Chronology for Waterfowl Species of GCJV Initiative Areas[1].





Data sources: 1970-1998 Louisiana Department of Wildlife and Fisheries coastal waterfowl transect survey.
1984-1997 U. S. Fish and Wildlife Service coastal waterfowl surveys of refuges and selected properties.
Redhead Surveys of Chandeleur Sound, LA (Tommy Michot, USGS-NWRC, unpublished data).

[1]Average proportion of the annual peak, relative to January (midwinter) survey. Data are not

[1]Average proportion of the annual peak, relative to January (midwinter) survey. Data are not available for Coastal Mississippi Wetlands and Mobile Bay Initiative areas.
[2]Southeast Louisiana.

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Appendix

Scientific Names of Plants and Animals Mentioned in This Plan

***I.* Plants alphabetical by common name.**

Common Name	Scientific Name
Alligatorweed	*Alternanthera philoxeroides*
American elm	*Ulmus americana*
Annual wildrice	*Zizania aquatica*
Bald cypress	*Taxodium distichum*
Beak rush	*Rhynchospora* spp.
Bulltongue arrowhead	*Sagittaria latifolia*
Cattail	*Typha* sp.
Common reed	*Phragmites australis*
Cordgrass	*Spartina cynosuroides*
Eurasian watermilfoil	*Myriophyllum spicatum*
Flatsedge	*Cyperus* sp.
Green ash	*Fraxinus pennsylvanica*
Hydrilla	*Hydrilla verticillata*
Laurel oak	*Quercus laurifolia*
Marshhay cordgrass	*Spartina patens*
Needlegrass rush	*Juncus roemerianus*
Olney bulrush	*Schoenoplectus americanus*
Overcup oak	*Quercus lyrata*
Panicgrass	*Panicum* sp.
Red maple or swamp red maple	*Acer rubrum*
Rushes	*Juncus* spp.
Sawgrass	*Cladium* sp.
Seashore saltgrass or inland saltgrass	*Distichlis spicata*
Shoalgrass	*Halodule wrightii*
Smooth cordgrass	*Spartina alterniflora*
Spikerush	*Eleocharis* spp.
Sugar hackberry	*Celtis laevigata*
Swamp cottonwood	*Populus heterophylla*
Swamp tupelo	*Nyssa biflora*
Sweetgum	*Liquidambar styraciflua*
Switchgrass	*Panicum virgatum*
Water hickory	*Carya aquatica*
Water oak	*Quercus nigra*
Water tupelo	*Nyssa aquatica*
Widgeongrass	*Ruppia maritima*
Wildcelery	*Vallisneria americana*
Willow oak	*Quercus phellos*

***II.* Waterfowl alphabetical by common name.**

Common Name	Scientific Name
American black duck	*Anas rubripes*
American wigeon	*Anas americana*
Black-bellied whistling duck	*Dendrocygna autumnalis*
Blue-winged teal	*Anas discors*
Canada goose	*Branta canadensis*
Canvasback	*Aythya valisineria*
Cinnamon teal	*Anas cyanoptera*
Fulvous whistling duck	*Dendrocygna bicolor*
Gadwall	*Anas strepera*
Greater scaup	*Aythya marila*
Greater white-fronted goose	*Anser albifrons*
Green-winged teal	*Anas crecca*
Lesser scaup	*Aythya affinis*
Lesser snow goose	*Chen caerulescens*
Mallard	*Anas platyrhynchos*
Mottled duck	*Anas fulvigula*
Northern pintail	*Anas acuta*
Northern shoveler	*Anas clypeata*
Redhead	*Aythya americana*
Ring-necked duck	*Aythya collaris*
Ross' goose	*Chen rossii*
Wood duck	*Aix sponsa*

III. Other animals alphabetical by common name.

Common Name	Scientific Name
American alligator	*Alligator mississippiensis*
Beaver	*Castor canadensis*
Feral pig	*Sus scrofa*
Muskrat	*Ondatra zibethicus*
Nutria	*Myocastor coypus*

Acknowledgments

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For More Information

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